

INTERFACE CONTROL DOCUMENT

FRONT END EQUIPMENT PROTECTION SYSTEM

to

PERSONNEL SAFETY SYSTEM

**ARGONNE NATIONAL LABORATORY
ADVANCED PHOTON SOURCE**

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ACRONYMS

The following are some of the frequently appearing or unique acronyms used in this document. This list is provided as a quick reference for the reader's convenience.

AB	Allen Bradley
ACIS	Access Control and Interlock System
APS	Advanced Photon Source
ASD.....	Accelerator Systems Division
AWG	American Wire Gauge
BIV	Beamline Isolation Valve
BL.....	Beamline
BM	Bending Magnet (Front End / Beamline)
BPM	Beam Position Monitor
CT	Cable Tray (600 volt rated cable, meets NEC-340)
ESG.....	Electrical Systems Group
FE.....	Front End
FEEPS	Front End Equipment Protection System
FEV	Front End Exit Valve
FOE.....	First Optics Enclosure
FV	Fast Valve
ICD.....	Interface Control Document
ID	Insertion Device (Front End / Beamline)
I/O	Input/Output
LS.....	Limit Switch
NC.....	Normally Closed Relay Contacts
NO	Normally Open Relay Contacts
PI.....	Position Indicator
PLC	Programmable Logic Controller
PLTC	Power Limited Tray Cable (300 volt rated cable, meets NEC-725)
PS.....	Photon Shutter
PSS.....	Personnel Safety System
SR.....	Storage Ring
SS.....	Safety Shutter
SSR	Solid-State Relay
SV	Slow Valve
TB.....	Terminal Block
TBB	Terminal Block Bank
TBD.....	To Be Determined
VDC	Volts Direct Current

REVISION RECORD

<u>Revision</u>	<u>Dated</u>	<u>Comments</u>
00	1/17/96	Initial release.
01	3/12/96	Review and release at ISIG formation.
02	2/12/03	Did away with the <i>PS1 Open Enabled</i> signal. Renamed <i>FE Ready</i> signal to <i>PS2 Permit</i> .
03	4/23/03	Renamed two signals. The <i>PS1 Open Command</i> signal is now called <i>PS1 Open Request</i> , and <i>PS2 Permit</i> became <i>FE Permit</i> .

1. SCOPE

The main functions of the interface between the Front End Equipment Protection System (FEEPS) and Personnel Safety System (PSS) are to protect the front end and beamline components from being damaged by synchrotron radiation.

This Interface Control Document (ICD) addresses the mechanical, electrical and operational aspects of the FEEPS to PSS interface.

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein.

2.1. APS Documents

- 2.1.1. Document No. 1111-00001-00 APS Quality Assurance Plan, dated May 1990.

2.2. Drawings

- 2.2.1. *PSS Distribution Panel Wiring Diagram 81-100*,
Drawing No. 302201-00

2.3. Precedence

In the event of conflict between the provisions of this specification and other documents, the following precedence shall apply:

- 2.3.1. This specification.
- 2.3.2. Documents referenced to the extent referenced herein.

3. OVERVIEW OF EQUIPMENT AND RESPONSIBILITIES

Signal exchange between the two systems is as follows.

3.1. PS1 Opened

3.1.1. Description

The ***PS1 Opened*** signal originates in the main PSS rack. The primary purpose of this information is to protect front end devices from damage by x-rays. The status of this signal is displayed on the FE control panel and in EPICS displays.

3.1.2. Operation

The ***PS1 Opened*** signal makes known to the FEEPS that PS1 is fully open, as monitored by the PSS Chain A. If the signal is true (1), the FEEPS concurs that it is safe to open photon shutter 2 (PS2), provided all interlocks downstream of the PS2 are satisfied. If the signal is false (0), the FEEPS prevents PS2 from opening.

3.1.3. Responsibility

The ***PS1 Opened*** signal from the PSS is the responsibility of the ESG PSS personnel.

3.2. PS2 Opened

3.2.1. Description

The ***PS2 Opened*** signal originates in the main PSS rack. The primary purpose of this information is to protect the front end and beamline devices from damage by x-rays. The status of this signal is displayed on the FE control panel and in EPICS displays.

3.2.2. Operation

The ***PS2 Opened*** signal informs the FEEPS that PS2 is fully open, as monitored by the PSS Chain A.

3.2.3. Responsibility

The ***PS2 Opened*** signal from the PSS is the responsibility of the ESG PSS personnel.

3.3. **SS1 Opened and SS2 Opened**

3.3.1. Description

The ***SS1 Opened*** and ***SS2 Opened*** signals originate in the main PSS rack. The primary purpose of this information is to protect safety shutters from damage by x-rays.

3.3.2. Operation

The ***SS1 Opened*** and ***SS2 Opened*** signals inform the FEEPS that the safety shutters are fully open, as monitored by the PSS Chain A. If both signals are true (1), the FEEPS concurs that it is safe to open PS2, provided all other interlocks downstream of the PS2 are satisfied. If any one of these signals is false (0), the FEEPS prevents PS2 from opening.

3.3.3. Responsibility

The ***SS1 Opened*** and ***SS2 Opened*** signals from the PSS are the responsibility of the ESG PSS personnel.

3.4. **PS1 Open Request**

3.4.1. Description

The ***PS1 Open Request*** signal originates in the relay rack housing FEEPS control electronics. This signal makes known to the PSS the demand to open PS1.

3.4.2. Operation

The ***PS1 Open Request*** signal is true (1) whenever the equipment protection interlocks downstream of the PS1 are made up and the 'PS1 Open' push-button in the FE Control Panel or in EPICS display are depressed. PSS will then allow PS1 to open. The signal turns false (0) if PS1 is not in the full open position within 10 seconds after the command has been issued. An equipment interlock trip in the section of the FE that is between the PS1 and PS2 or pressing the 'PS1 Close' button will also make the signal false. Table 3-1 on page 10 summarizes the signals sent from the FEEPS to PSS.

3.4.3. Responsibility

The ***PS1 Open Request*** signal from the FEEPS is the responsibility of the ESG FEEPS personnel.

3.5. FE Permit

3.5.1. Description

The ***FE Permit*** signal originates in the relay rack housing FEEPS control electronics. This signal makes known to the PSS that all FEEPS interlocks are satisfied.

3.5.2. Operation

When the ***FE Permit*** signal is true (1), PSS concurs that is safe to have all FE shutters open. Should the signal turn false (0), the PSS will immediately close PS2 and both safety shutters. PS1, however, will remain open as long as the ***PS1 Open Command*** signal is true. See Table 3-1 below.

3.5.3. Responsibility

The ***FE Permit*** signal from the FEEPS is the responsibility of the ESG FEEPS personnel.

Table 3-1 PSS Response to FEEPS Signals

PS1 Open Request	FE Permit	PSS Action
1	0	PS2 will close, PS1 will remain open.
0	0	PS1 and PS2 will close

1	0 or 1	PS1 will open
0 or 1	1	PS1 and PS2 will open or stay open

Note: The FEEPS is programmed not to allow the *FE Permit* signal to be asserted on (= 1) if it is unsafe to open PS1.

3.6. Related Interface Control Documents (ICDs)

There are no related ICDs that impact this interface.

4. INTERFACE CHARACTERISTICS

The interface is, mechanically, an instrumentation (tray rated) cable terminated in the FE End Rack and in the PSS main rack. Six signals are required between these racks. A block diagram of the interface is shown in Figure 4-1.

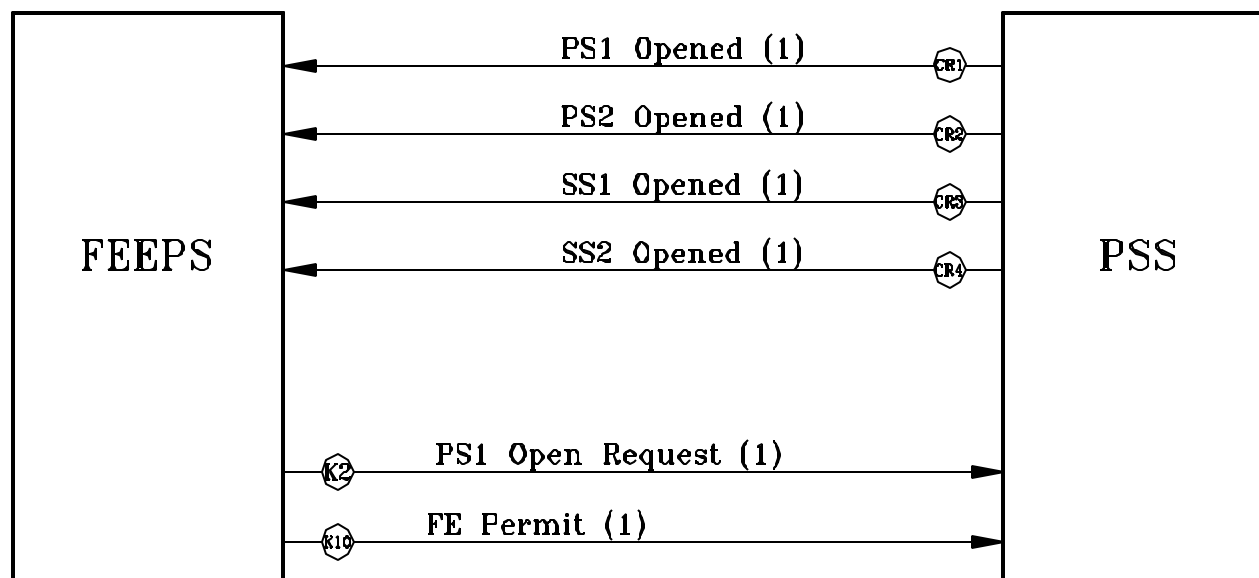


Figure 4-1 Interface Block Diagram

4.1. Physical Requirements

The physical requirements for the interface are the accessibility and identification requirements. The terminal blocks (TBs) shall be placed such that there is sufficient

space around them to allow access for testing and troubleshooting. The TB banks require labels be placed identifying that the TB banks are part of the FEEPS to PSS interface. The cable requires labels be placed at both ends.

4.2. Mechanical Interface

The mechanical interface is a bank of WAGO front-entry, rail-mounted terminal blocks located inside the FE End Rack and main PSS equipment rack. Devices that interface the signals between the FEEPS and PS include TBs, mounting rails, relays, fuses, and cable.

4.2.1. Cable

A multiconductor instrumentation/process control cable shall be used for the interface. The cable is a 20 conductors, 20 AWG, overall foil shielded Alpha No. 45470/20. The jacket is of high/low temperature thermoplastic rubber construction. The cable is classified as Power Limited Tray Cable (PLTC) 300 volts. The tray cable is a factory-assembled multiconductor or multipair signal, control, or power cable specifically approved under the National Electrical Code (NEC) for installation in cable trays.

Pulling the interface cable between the FEEPS and PSS cabinets is the responsibility of the ESG FEEPS personnel.

Terminating the cable in the FE End Rack and installing the necessary labels is the responsibility of the ESG FEEPS personnel.

Terminating the cable in the PSS rack and installing the necessary labels is the responsibility of the ESG PSS personnel.

Cable drain wire shall be connected to ground at the FEEPS end only, and shall be cut off at the PSS end.

4.2.2. Terminal Blocks

A series of front-entry DIN rail mounted WAGO Through TBs shall be utilized to terminate the cable. The TBs will be located inside the FE End Rack and main PSS rack. The FEEPS will also use 1 WAGO Ground TB to terminate shield drain wire.

4.2.3. Mounting Rails

DIN metal mounting rails shall be used for mounting the TBs and relays. The rail dimensions are 35 mm x 7.5 mm, 1 mm thick. The rails shall be perforated at the bottom. Perforation dimensions are 25 mm x 5.2 mm, with 36 mm spacing between them. The IBOCO part number for the rails is Omega 3FD.

4.2.4. Fuses

The power distribution wiring in the FE End Rack and PSS cabinet shall be fuse protected at the bus with two fuses. Both the +24VDC and DC common lines shall be fused. Fuse specifications: 3A fast-acting.

4.3. Electrical/Electronic Interfaces

- a) All interface signals shall utilize +24VDC voltage level.
- b) All FEEPS to PSS interface signals shall be relay isolated.
- c) Outputs from both systems shall drive relay coils, and the contacts of these relays shall be used as inputs by the interfacing system.
- d) The interface cable shall be protected against dead shorts to ground (even if the power supply is floating) by fusing either the individual cable or at the DC distribution bus.

4.3.1. Wiring Diagram

The interface shall be wired as shown in Figure 4.3.1-1 below.

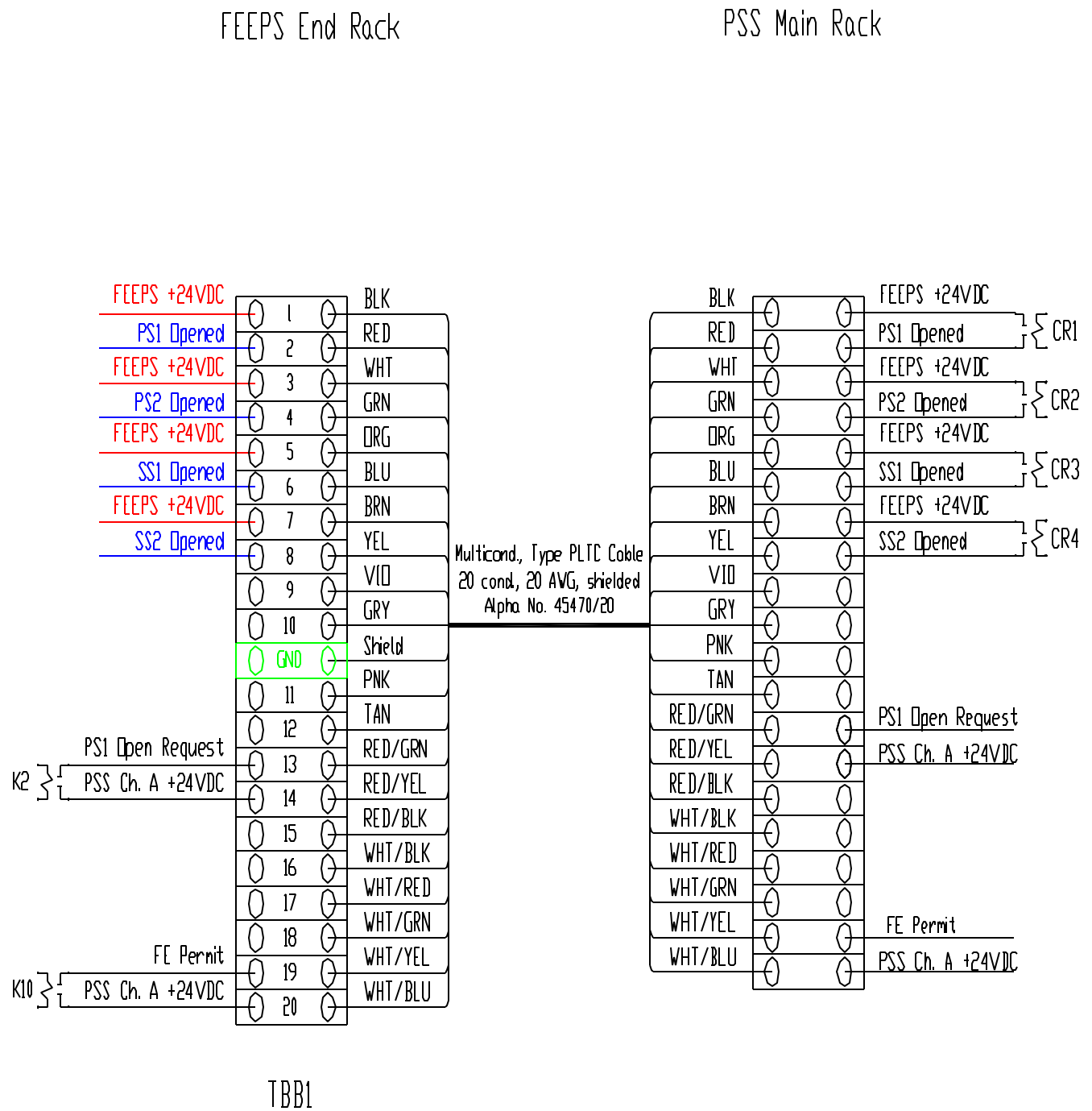


Figure 4.3.1-1 Interface Wiring Diagram

5. **SAFETY CONSIDERATIONS**

5.1. Voltage

Low voltage DC circuitry is used for status and control signals (+24VDC).

5.2. Fail Safe

By using normally open (NO) status switches, sets of NO relay contacts, and positive logic, 'true high', the system is inherently fail-safe to faults such as loss of power or open circuits.